Research Highlight

Reanalysis data have been widely used in various climate-related studies; for example, they serve as "surrogate observations" where there are either no observations or only sparse observations, or as boundary conditions for regional climate modeling. Evaluation of cloud properties in reanalysis also directly sheds light on the deficiencies of relevant parameterizations in climate models because cloud observations have been not assimilated in most reanalyses. However, observational evaluation of cloud-related properties is limited, especially in terms of using surface-based observations. In a recent study published in the Journal of Geophysical Research, Department of Energy scientists at Brookhaven National Laboratory and their collaborators took advantage of the long-term surface-based observations collected by the ARM Climate Research Facility at the Southern Great Plains site to evaluate three major Numerical-Weather-Prediction reanalyses (ERA-Interim, NCEP/NCAR Reanalysis I, and NCEP/DOE Reanalysis II) in modeling surface relative shortwave cloud forcing, cloud fraction, and cloud albedo.

The results show that the reanalyses significantly underestimate the cloud properties. The model biases are positively related to one another and are somewhat related to cloud fraction magnitude.

The cloud properties are shown strongly related to 2-m relative humidity, especially for the observations and ERA-Interim, suggesting that clouds are closely coupled to the Earth's surface and boundary-layer processes. Addressing the surface-boundary-layer-cloud coupling thus presents a pressing need for improving further model development and evaluation.

Reference(s)

Wu W, YG Liu, and AK Betts. 2012. "Observationally based evaluation of NWP reanalyses in modeling cloud properties over the Southern Great Plains." Journal of Geophysical Research – Atmospheres, 117, D12202, doi:10.1029/2011JD016971.

Contributors

Yangang Liu, *Brookhaven National Laboratory*; Wei Wu, *Brookhaven National Laboratory*

Working Group(s)

Cloud Life Cycle
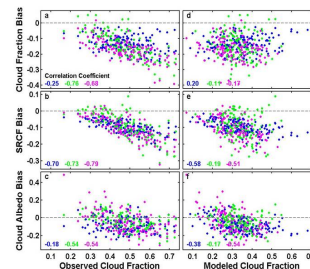
These scatter plots show the relationship of the model biases in the cloud properties to the observed and modeled cloud fraction. Blue, green, and purple represent ERA-Interim, R1, and R2, respectively. The colored numbers represent correlation coefficients for the same colored data points.